

EE Showcase

Design Options

ECE 403 – Senior Design II
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Document prepared by
Tyson Morlock
Aaron Aaberg
Jared Gratzek
Dane Swartz
Jake Goodell

Introduction

The objective of our project is to create an entertaining and educational EE Showcase that shows many different concepts from Electrical and Computer Engineering. The machine will be shown to high school students and underclassmen and show various topics, ranging from Physics and Calculus to Embedded Systems and Signal Processing. Concepts shown by the machine will be further expanded upon inside of an accompanying binder and/or informative presentation embedded inside of devices. The machine is small enough to fit in the back of a car for easy transport to local department events and is powered off of a common AC power.

Along with the EE Showcase we will be creating a detailed Xbee manual for future students that are interested in the technology. This instructional document will be neatly organized and contain concise and clear instructions. This to-the-point document will be very easy to follow and save groups a lot of time researching the technology. The final document will be readily available to North Dakota State University Electrical and Computer Engineers as well as the possibility of accessing an online version which would be upgradable and editable. The Xbee manual will also contain an extensive troubleshooting section which will aid in overcoming issues in Xbee wireless communication as well as some code for projects. This document will allow students to better understand Xbees as well as the Zigbee wireless communication protocol.

Prior Art

Dubstep (Audio Box)

'Dubstep' is a genre originating in England that uses a lot of low frequency baselines and reverberant drum beats. The 'Dubstep' uses a low frequency oscillator. There are no patents specifically for a LFO. It is too broad of a design. It's not something reasonable to patent.

LED CUBE

There are no patents specifically for an LED cube currently.

Videos of previously made cubes and construction tutorials

- <http://www.youtube.com/watch?v=6mXM-oGggrM>
- <http://www.youtube.com/watch?v=cLLyfop3QI>
- <http://www.youtube.com/watch?v=IFDcdN47V5s>
- <http://www.youtube.com/watch?v=dVHP7Nhsn4E>



Written Construction Tutorials

- <http://picprojects.org.uk/projects/lc/>
- http://courses.cit.cornell.edu/ee476/FinalProjects/s2008/pae26_rwc28/pae26_rwc28/index.html

Green Energy Box

Solar Panel

A novel solar panel is disclosed which has a supporting substrate which is comprised of one or more plies of resin reinforced novoloid fabric.

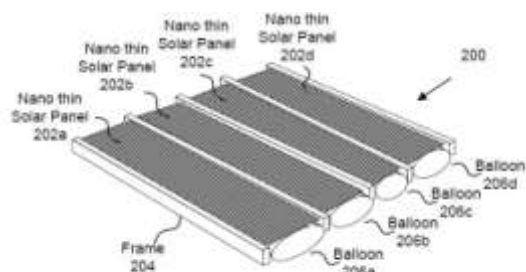


FIG. 2

Inventor: Erich F. Kujas

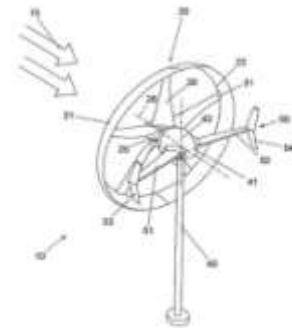
Original Assignee: RCA Corporation

Current U.S. Classification: 136/245; 136/292

International Classification: H01L 2502

Wind Turbine

A vertical axis wind turbine includes a pair of wind deflectors for directing the wind current into the rotor assembly. The wind deflectors are connected to the wind turbine so that their positions are automatically adjusted as a function of wind velocity as well as wind direction to maximize efficiency. The wind deflectors automatically move to a position downwind of the rotor assembly during periods of unusually high wind velocity and actuate a rotational governor which increases the angular inertia of the turbine to limit the speed of the turbine shaft during such high wind conditions.



Inventor: David R. Yeoman

Current U.S. Classification: 415/4.2; 416/41

International Classification: F03D 706

Fiber Optic Tree

A decorative fiber optic tree formed of a plurality of light conducting optical fibers, each having a first end and a second end. The fiber optic tree includes a base unit having an interior chamber to house a light source. The light source is arranged to produce light that is directed through an opening on an upper surface of the base unit. An elongated and perforated center tube may be included having a top end and a bottom end, and is substantially vertically oriented. The center tube, which is removeably mounted on the base unit, is positioned at least in part over the opening in the upper surface of the base. The optical fibers are disposed partially within the center tube with the first end of each fiber located near the bottom end of the center tube and suitably positioned to enable light from the light source passing through the opening to be coupled into each respective optical fiber. The optical fibers extend partially up the interior of the center tube, with each passing...



Inventor: Wilson Harris, Jr.

Primary Examiner: Ismael Negron

Current U.S. Classification: 362/564; 362/567; 362/568; 362/805; 362/806

International Classification: F21S 100

Simple Project Box

Crystal Radio

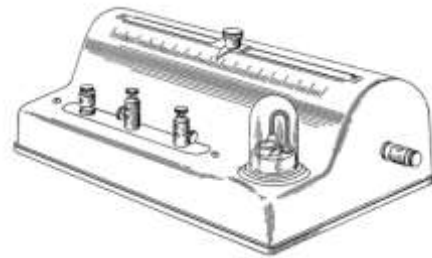
Inventor: H. ADAMS

Current U.S. Classification: 329/370;
455/337; 455/347

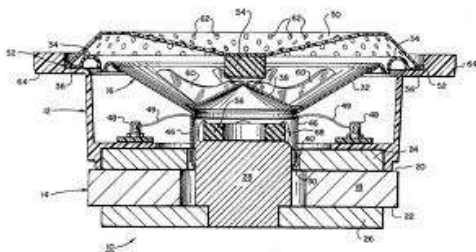
Patent number: 1748435

Filing date: Mar 12, 1926

Issue date: Feb 25, 1930



Homemade Speaker



A speaker in which the basket holding the voice coil, cone and damper has a ribbed top flange and a ribbed bottom flange, a gasket is capped on the suspension of the cone at the ribbed top flange and fastened thereto with screws without the use of glue, and a holder frame is pressed on the periphery of the damper at the ribbed bottom flange and fastened thereto with screws.

Inventor: Steff Lin

Current U.S. Classification: 181/148; 181/157

International Classification: H05K005/00; H04R007/00; G10K013/00

Application number: 10/698,474

Publication number: US 2005/0092543 A1

Filing date: Nov 3, 2003

Issued patent: US7025170 (Issue date Apr 11, 2006)

Design Options

Build off of old Rube Goldberg machine.

PROS:

- Parts of the machine are already together
- There's an Etch-a-sketch ®
- Smaller budget

CONS:

- Unsure what parts are working and which aren't
- Forced to build on board
- Initial machine is lame
- Impossible to trouble shoot
- Likely need to replace parts
- Doesn't look finished, very scrappy
- Wires running everywhere
- Not visually appealing
- No flow of the layout

Build using components of old machine.

PROS:

- Parts are already there
- Minimizes effort
- Incorporate class projects into design
- Legacy continues for 3rd year

CONS:

- Troubleshooting problems
- No appealing components
- Focus on other peoples work
- Old parts not satisfying
- 3rd year working on this project
- Not personally our own work

Build own EE Showcase.

PROS:

- Incorporate class projects into design
- More pride in our own work
- Full control
- Avoid troubleshooting
- Setup own platform
- Cleaner, uniform look
- Higher quality of project
- Learn more working on different aspects

CONS:

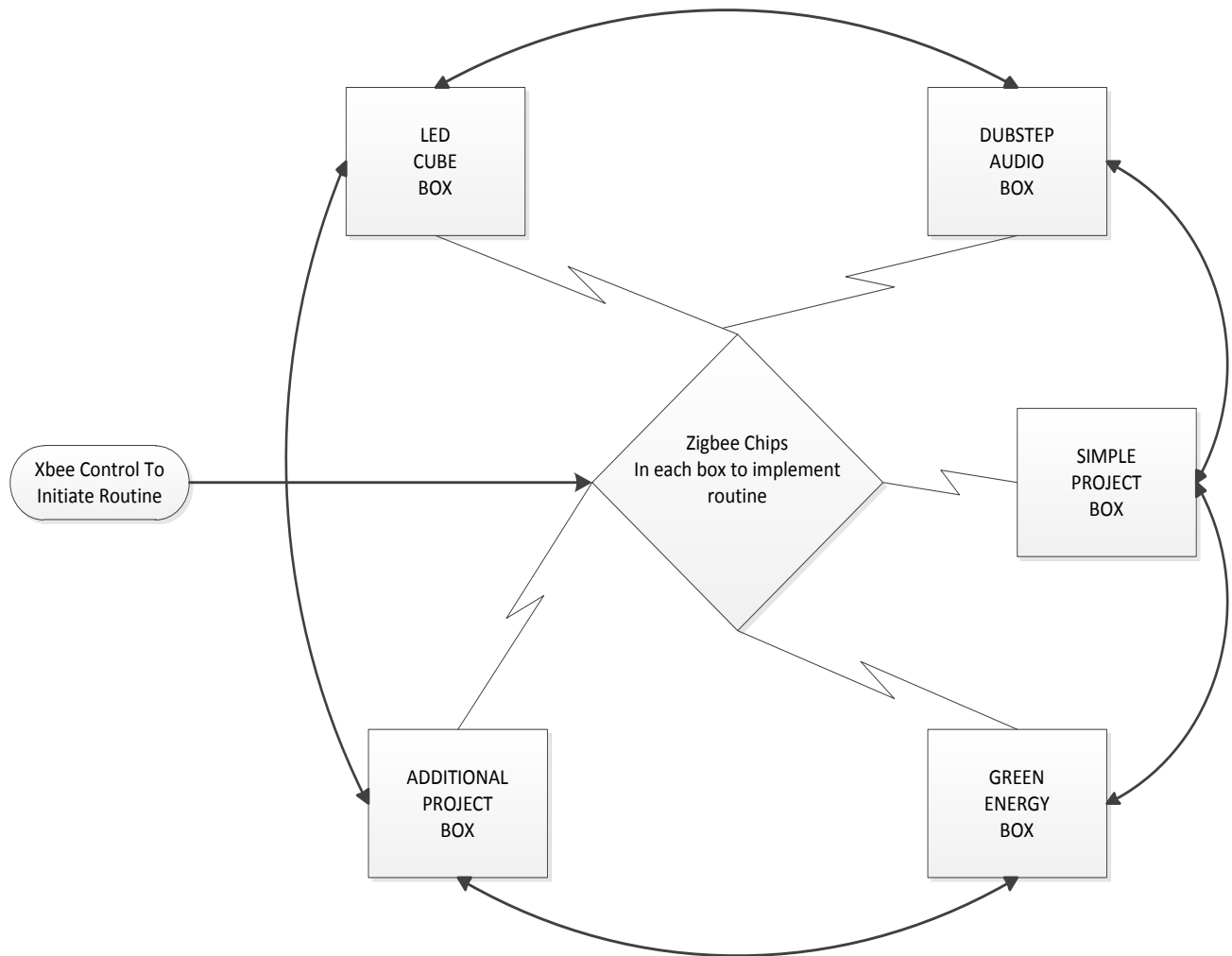
- More effort required
- Higher budget
- More planning required

Selected Options

After a great debate we decided on going with building our own EE Showcase from the ground up based off of the Xbee idea. This will allow us to have full control and not be forced to squeeze the old components into our contraption. This option will also allow for us to get a better understanding on what we're working on.

All negatives of this selected project are also negotiable. Seeing how this route will require more effort in planning we all believe the work will pay off with all the experience we will attain. This experience and work will also be great material to show future employers as well as prepare us for the real world. The requirement of more planning time is also great as it will allow for us to all be on the same page throughout the project and allow all group members to have their input on the project. Taking this approach allows for every member to be a leader instead of following one individual. This leadership experience also helps in our future. The higher budget on the project can be reduced by spending more time on planning and possibly researching alternatives in technology more. That way we will be able to spend less money on higher quality components.

Design Flowchart



(note: Communication between boxes will be done wirelessly)

Box Descriptions

Dubstep (Audio Box)

This box will go off of Tyson's patent of his dubstep sound modulator. It will need to produce the modulation as well as have effects that show off other concepts different than signal processing. The effects will be used to show off the musical modulations and sounds heard in Dubstep music as well as grabbing the audience's attention.

Suggested ideas to include(subject to change):

- Produce 'Dubstep' sound w/ frequency modulations
- Project sound through subwoofer amplifier (must have enough Bass)
- Produce drum beat
- Include lights and strobes
- Mechanical arm moving to drum beat

LED CUBE

This box will be used to gain 'oohs and ahhs.' The box will contain a LED array of a reasonable dimension that will light up in different shapes and arrangements to give a 3-D figure effect or show.

Suggested ideas to include(subject to change):

- Multiple colors
- Single colors
- Minimum of 3x3x3 cube
- Possibly be sensitive to sounds made by aforementioned "Dubstep" box

Green Energy Box

The green energy box will showcase various forms of green, renewable energy. It will show off different forms like wind and solar that translates to electrical power distribution. The design setup of the box will have continuity from one form of energy harnessing to another.

Suggested idea to include (subject to change): A fan generating wind for a windmill, that will power a light on the windmill. The light will be cast on a solar panel that in turn lights up a fiber optic cable representing trees.

Simple Project Box

The simple project box will contain various easy and simple electronic devices that can be made with household or common objects.

Suggested ideas to include (subject to change):

- Homemade speaker
- Crystal radio
- Simple motor
- Homemade audio amplifier

Budget

Part	Qty	Estimate	Total	Notes
Plexiglass boxes	4	\$38.00	\$114.00	Estimate is for Basketball Display case which could be modified for our design.
Baseboard	4	\$4.00	\$12.00	Used for boxes
Xbee Adaptor	4	\$36.00	\$108.00	Wireless communication between boxes
PIC Microprocessor	4	\$7.70	\$23.10	Micro we will be using
Custom PCB Board	4	\$51.00	\$153.00	Necessary for standalone board with mounted Xbee
Other Electronics	4	\$40.00	\$120.00	Misc. parts that will be needed for box designs
Power Strip	4	\$10.00	\$30.00	For wall outlets if needed (might be unnecessary in some boxes)
Assorted Power Adapters	4	\$15.00	\$45.00	For Micro or other devices if needed
Case Lock	4	\$9.00	\$27.00	Optional
Duplicate Key	4	\$4.00	\$16.00	Optional
In-home PCB	4	Free	Free	This could be printed on the PCB milling machine run by Kostic Koziy
LED's	>512	~\$20.00	~\$20.00	Blue LED's in lots of 1000 can be purchased for this price (could be more if go RGB LED route)
Mounting Hardware	1	\$10.00	\$10.00	Any sort of screws/hardware needed (likely free from Jeff)
Small Fan	1	\$10.00	\$10.00	Used in "Green" box to visualize wind power (likely free from Jeff)
Small Solar Panel	1	\$59.95	\$59.95	Standard small 5W solar panel (working solar panel might be unnecessary)
Windmill	1	?	?	Windmill may be paper or similar to a small fan (likely free from Jeff)
Stepper Motor	2	\$15.00	\$30.00	Used for "Dubstep" box to produce backbeat or move drum arm
Fiber Optic cable	1	\$20.00	\$20.00	Use "Fiber Optic Light" to demonstrate fiber optic properties
Simple Speaker	1	\$1.00	\$1.00	
Quaker Oats Can (for radio)	1	Free	Free	Someone will need to enjoy some Quaker Oats
Gold	1	\$1,000,000	\$1,000,000	For Aaron (optional)
Total			\$799.05	Proposed budgets are \$500 for design projects, but we can use Jeff and his parts stock as a resource to get many costly items for free (Xbee)

Timeline for First Semester and Second Semester

Weeks	3	4	5	6	7	8	9	10	11	12	13	14	15	16	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Members
Initial Planning:																															All
Research Planning:																															All
Research Design:																															All
Options Design:																															All
Order Parts Round 1:																															All
Order Parts Round 2:																															All
Research Xbee:																															DS,AA
Xbee Manual Rough Draft:																															DS,AA
Xbee Manual Revision:																															DS,AA
Xbee Web Document:																															DS,AA
Xbee Circuit Building:																															DS,AA
Xbee Troubleshooting:																															DS,AA
Xbee Networking:																															DS,AA
Xbee Coding:																															DS,AA
Create Inhome PCBs:																															All
Order PCBs:																															All
Ultiboard PCBs:																															All
Schematics in Multisim:																															All
Ultiboard PCB Improvements:																															All
Schematics Revision																															All
Showcase 1: LED Cube																															JG
LED Cube Research/Planning																															JG
LED Cube Design																															JG
LED Cube Circuit Building/Coding																															JG
LED Cube Troubleshooting																															JG
LED Cube Touch-Up/Finishing Touches																															JG
Showcase 2: Dubstep Box																															TM
Dubstep Research/Planning																															TM
Dubstep Design																															TM
Dubstep Circuit Building/Coding																															TM
Dubstep Troubleshooting																															TM
Dubstep Touch-Up/Finishing Touches																															TM
Showcase 3: Green Energy																															JG
Green Research/Planning																															JG
Green Design																															JG
Green Circuit Building/Coding																															JG
Green Troubleshooting																															JG
Green Touch-up/Finishing Touches																															JG
Showcase 4: Simple project box																															AA
Simple Box Research/Planning																															AA
Simple Box Design																															AA
Simple Box Building/Coding																															AA
Simple Box Troubleshooting																															AA
Simple Box Touch-up/Finishing Touches																															AA

Summary

Our project consists of boxes that wirelessly communicate to each other and form a network of devices that showcasing specific Electrical Engineering disciplines. With a projected cost of ~\$800, the group will need to not only overcome challenges of designing the boxes themselves, but also cut costs to try and get this design under budget(\$500). Our plan is to complete two boxes a semester in conjunction with the Xbee wireless tutorial for future NDSU ECE students. Finally, the project will not only provide team work and design experience for each of the five members, but also resources that can be used in the future by the NDSU ECE department.